manency in proportion to their induracy is also another strong point. The soft ones of the *Strobus* section retain vitality little longer than some true leaves, while the spinescent ones of *P. austriaca* remain green for four or five years. But the strongest of all points is, that on dissection of an old fascicle, it will be found to have a distinct connexion with the woody system of the tree, and that these minute woody axillæ under each fascicle increase in size with the age of the sheath. With a very little encouragement these woody axillæ can be induced to elongate and become real branchlets. If the leading shoot, for instance, of a pine be tipped in May just after pushing, bulblets will form in every fascicle below, and the next season the bulblets will produce weak branchlets, although this might be said of true leaves, which are supposed to bear an embryo shoot in the axil of every one. So much stress need not be put on this fact, as the others are sufficient; it is introduced, and its weak nature commented on, as it furnishes the chief point in Dr. Dickson's argument for *Sciadopitys*, which amounts to little more than that the apparently single phyllon is really a double one—a two-leaved fascicle united by a transformed sheath through its whole length. Carrière has since pushed Dr. Dickson's observations further by noting, in the 'Revue Horticole,' really bifid leaves, with little verticils in the axils (see reference in 'Gardeners' Chronicle,' May 2, 1868)—an observation which I confirm by a specimen exhibited herewith; yet, as I have said, it is by itself not wholly free from the objection that it may be but a modified form of regular bud-growth; but, together with my other observations, I think they do serve to confirm the point of these so-called leaves being but phyllodea.

In conclusion, I will restate the main points of this paper:—

The true leaves of Coniferæ are usually adnate with the branches.

Adnation is in proportion to vigour in the genus, species, or in the individuals of the same species or branches of the same individual.

Many so-called distinct species of Coniferæ are the same, but in various states of adnation.—*From the forthcoming volume of the Proceedings of the American Association for the Advancement of Science.* (Communicated by the Author.)

Mechanical Reproduction of the Flight of Insects. By M. Marey.

The author has already shown that by gilding the tips of the fore wings of a hymenopterous insect and allowing it to fly in the sun, the point of each wing is found to describe a figure of 8, indicating that in the course of one elevation and descent the wing moves twice forward and twice backward. To ascertain how this movement is produced, the author took a small glass rod blackened with smoke, and by presenting it to the wing in different parts of its passage, he found that the soot was rubbed sometimes on the upper and sometimes on the lower surface, according as the rod was held below or above the course of the wing forwards or backwards. From his experiments he concludes that the wing moves from behind forwards both in its descent and in its ascent.

That the plane of the wing changes twice during each movement appears from the difference in the brilliancy of the two branches of the luminous figure of 8. When a branch is very brilliant, this is because it presents its gilt surface at a favourable angle for the reflection of the sun's light. During descent the wing presents its upper surface a little forward, whilst during elevation this surface looks rather backward.

These movements are so complex that they would require a very complex muscular apparatus if each of them was the result of a special act. It would require a very perfect coordination to enable these eight or ten successive actions to be reproduced in regular order at each revolution of the wing—that is to say, from two hundred to three hundred times in a second; but the simple elevation and depression of the wing is sufficient to enable the resistance of the air to produce all the other movements. The wing being rigid in front, in consequence of its thick nervures, the flexible hinder part, being raised by the resistance of the air during the rapid depression of the wing, will acquire an oblique direction, so that the upper surface of the wing will look forward; on the other hand, during elevation the resistance of the air will be above, and the upper surface of the wing will incline backwards. This figure-of-8 movement exactly resembles the motion of the oar in sculling a boat.

To verify his theory, the author has constructed a small apparatus, which he describes as follows:—A mechanism set in motion by an air-pump caused the alternate elevation and depression of a pair of wings constructed on the plan of those of insects. This apparatus had not sufficient motive power to raise its own weight; but it was placed upon a pivoted rod in equilibrium, so that, if the apparatus developed the motive power required by the theory, the whole would acquire a movement of rotation round a central axis. On being set in action, the apparatus rotated rapidly.

By gilding the tip of one of the wings of this artificial insect, all the movements and changes of plane executed in the flight of an insect were reproduced by the apparatus; and as the force derived from the pump can only produce elevations and depressions of the wing in the same plane, it is evident that the other movements are produced by the resistance of the air.

The origin of this theory of flight is to be found in Borelli, who supposes that the wing of a bird acts upon the air in the manner of a wedge. Strauss-Durckheim states this opinion more clearly, and shows how the insect derives, from the resistance of the air to the inclined plane of its wing, a combination which it employs to sustain and guide itself. Girard has made experiments to show the correctness of Strauss-Durckheim's hypothesis, and proved that if the flexibility of the hinder margin of the wing be altered by a dry coating of any kind, the power of flight is destroyed.—*Comptes Rendus*, March 15, 1869, tome lxviii. pp. 667–669.